QUESTION 1

Decimal to Binary

Integer part (255):

Repeatedly divide by 2.

255 ÷ 2 = 127 remainder 1

127 ÷ 2 = 63 remainder 1

63 ÷ 2 = 31 remainder 1

31 ÷ 2 = 15 remainder 1

15 ÷ 2 = 7 remainder 1

7 ÷ 2 = 3 remainder 1

3 ÷ 2 = 1 remainder 1

1 ÷ 2 = 0 remainder 1

Reading remainders bottom to top:

255 = 11111111 (IN BINARY)

Fractional part (0.375):

Multiply repeatedly by 2. The integer part becomes the next binary digit

0.375 × 2 = 0.75 = 0

0.75 × 2 = 1.5 = 1

$0.5 \times 2 = 1.0 = 1$

0.375 = 0.011 (IN BINARY)

So final answer is:

255.375 = 11111111.011

Decimal to Octal

Repeatedly divide by 8

$255 \div 8 = 31$ remainder 7

$31 \div 8 = 3$ remainder 7

$3 \div 8 = 0$ remainder 3

255 = 377 (IN OCTAL)

Fraction:

$0.375 \times 8 = 3.0$

0.375 = 0.3

Final Octal Answer:

377.3

Decimal to Hexadecimal

Divide by 16.

$255 \div 16 = 15$ remainder 15

$15 \div 16 = 0$ remainder 15

Remainder 15 = F

255 = FF

Fraction:

$0.375 \times 16 = 6.0$

$0.375_{10} = 0.6_{16}$

Final Hexadecimal Answer: FF.6

QUESTION 2

110101= 1*2^5+ 1*2^4 + 0*2^3+ 1*2^2 + 0*2^1 + 1*2^0 = =32+16+4+1=53

1012=1×2^-1+0×2^-2+1×2^-3= =0.5+0.125=0.625

Final Answer

110101.101 = 53.625

QUESTION 3:

A binary number is divisible by 3 if the difference between:

• the sum of bits in odd positions, and

• the sum of bits in even positions

is divisible by 3.

Positions are counted from right to left.

Binary number: 100111

Position: 6 5 4 3 2 1

Bits: 1 0 0 1 1 1

Odd positions (1, 3, 5):

Position 1 = 1

Position 3 = 1

Position 5 = 0

Sum = 1 + 1 + 0 = 2

Even positions (2, 4, 6):

Position 2 = 1

Position 4 = 0

Position 6 = 1

Sum = 1 + 0 + 1 = 2

Difference = 2 − 2 = 0

Since the difference is 0, which is divisible by 3,

the binary number 100111 is divisible by 3.

Conclusion:

100111 (base 2) is divisible by 3.

QUESTION 4

23 in binary is: 00010111

Taking the 1’s complement:

Invert all bits (change 0 to 1 and 1 to 0):

11101000

Adding

1 to get 2’s complement

11101000

+

1

11101001

Final Answer:

−23 in 8-bit 2’s complement is:

11101001

QUESTION 5

$F = (A + B)(A' + C)(B + C')$

$(A + B)$: Either A is true OR B is true.

$(A' + C)$: Either A is false OR C is true.

$(B + C')$: Either B is true OR C is false.

For F to be true, all three conditions must be satisfied simultaneously.

Now,

$(A + B)(A' + C)=$

$A \cdot A' = 0$ (a variable and its complement cannot both be true)

$A \cdot C$

$B \cdot A'$

$B \cdot C$

After removing the impossible term:

$= AC + A'B + BC$

Multiply with the third term

$(AC + A'B + BC)(B + C')$

Checking each product:

$AC \cdot B \rightarrow$ valid

$AC \cdot C' \rightarrow 0$

$A'B \cdot B \rightarrow A'B$

$A'B \cdot C' \rightarrow$ redundant

$BC \cdot B \rightarrow BC$

$BC \cdot C' \rightarrow 0$

After removing invalid and redundant terms:

$F = A'B + AC$

Final Simplified Expression:

$F = A'B + AC$

The output F is 1 when:

1) A is false and B is true, OR

2) A is true and C is true.

QUESTION 6:

On converting numbers in Binary

m1 = 001

m3 = 011

m5 = 101

m7 = 111

Looking at these minterms, notice that:

• In every case, C = 1

• A and B change, but C remains constant

When plotted on a 3-variable K-map:

• All the 1s fall in the column where C = 1

• This entire column can be grouped together

Because the group covers all combinations of A and B,

those variables get eliminated.

Final Simplified Expression:

F = C

Pattern Observed:

All the 1s lie in a single column of the K-map, showing that the function depends only on variable C.